FOREST PEST CONDITIONS IN CALIFORNIA-1989

A PUBLICATION OF THE CALIFORNIA FOREST PEST COUNCIL

THE CALIFORNIA FOREST PEST COUNCIL (formerly the California Forest Pest Control Action Council) was founded in 1951. Membership is open to public and private forest managers, foresters, silviculturists, entomologists, pathologists, zoologists, and others interested in the protection of forests from damage caused by animals, diseases, insects, and weeds. The council's objective is to establish, maintain, and improve communication among individuals -- managers, administrators, and researchers -- who are concerned with these issues. This objective is accomplished by four actions:

1. Coordination of detection, reporting and compilation of pest damage information.

2. Evaluation of pest conditions.

3. Pest control recommendations made to forest managing agencies and landowners.

4. Review of policy, legal, and research aspects of forest pest control, and submission of recommendations thereon to appropriate authorities.

The California Board of Forestry recognizes the Council as an advisory body in forest pest protection. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry and Conservation Association.

The report, **FOREST PEST CONDITIONS IN CALIFORNIA - 1989**, is compiled for public and private forest land managers to keep them informed of pest conditions on forested land in California, and as an historical record of pest trends and occurrences. The report is based largely on information provided by three sources: (1) the state-wide Cooperative Forest Pest Survey, in which federal, state, and private foresters and land managers participate, (2) information generated by Forest Pest Management, Pacific Southwest Region, USDA-Forest Service, while making formal detection surveys and biological evaluations, and (3) reports and surveys of conditions on private lands provided by personnel of the California Department of Forestry and Fire Protection.

This report was prepared by the Forest Service in cooperation with other member organizations of the Council. It was duplicated and distributed by the California Department of Forestry and Fire Protection.

Cover: In the lunar calendar, 1989 was the Year of the Snake, but in California it was the year of the fir engraver, Scolytus ventralis. The fir engraver caused extensive top-kill, branch dieback, and mortality in true firs throughout areas of California with insufficient precipitation.

Sacramento February 23, 1990

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HIGHLIGHTS OF PEST CONDITIONS - 1989

STATUS OF INSECTS. Mortality caused by bark beetles and drought stress has visibly increased in all parts of the state. Mortality in the northwest tends to be scattered, rather than groups of trees. The heaviest concentrations of mortality are found in the true fir types and in Douglas-fir along some of the major river drainages.

The fir engraver, Scolytus ventralis, along with other Scolytus species and flatheaded borers, attacked red and white firs in Siskiyou and Shasta Counties in the north, and along the mountain spine of California from Lassen to Kern County. Mortality was extensive in some areas.

Western pine beetle, pine engravers, and the red turpentine beetle caused pine mortality on private and public lands throughout the state. Mountain pine beetle was responsible for losses of sugar pine and lodgepole pine. Cedar bark beetles were increasingly common.

The outbreak of Douglas-fir tussock moth in Lassen and Plumas Counties was treated with Bacillus thuringiensis, and new egg masses were difficult to locate. The number of male gypsy moths trapped in California has increased, along with the number of counties involved.

STATUS OF DISEASES. Visible damage to a variety of conifer and shrub species along major highways was caused by deicing salt in the Lake Tahoe Basin. Phytotoxicity also occurred along several highways in northern California.

It was reported that the severity of pitch canker infections, caused by Fusarium subglutinans, appears to have declined in Santa Cruz County. New locations infested with pitch canker were found in Santa Barbara, Los Angeles and San Diego Counties.

The number of elms detected and removed due to Dutch Elm disease infection was the lowest in the quarantine area since 1984.

Dwarf mistletoe and root disease continue to be the most damaging forest pests in California. The level of infestation of these two disease problems is similar to that seen in previous years.

Increased levels of branch flagging of red fir caused by dwarf mistletoe, cytospora canker, and drought were observed in much of the state.

STATUS OF WEEDS. A third year of drought intensified vegetative competition in much of California. Competition remained a serious threat to the success of reforestation efforts in recent burns. Resumption of the use of herbicides on National Forest lands is scheduled for 1990. Several appeals to the Vegetative Management Final Environmental Impact Statement are pending.

STATUS OF ANIMAL DAMAGE. Animal damage to forests is not on the decline in California. Pocket gophers, black bear, and deer continue to be significant problems, and indications are that pocket gopher and black bear damage is on the increase. With additional restrictions on the use of strychnine as a rodenticide, continued damage must be anticipated.

Figure 1. Participants in the insect field committee meeting gather to hear the history of efforts to suppress the Jeffrey pine beetle at Kiva Estates, Kiva Beach Picnic Area, South Lake Tahoe, August 30, 1989. (Photo courtesy of J. W. Dale)

STATUS AND CONTROL OF INSECTS

WESTERN PINE BEETLE, Dendroctonus brevicomis. In general, mortality caused by the western pine beetle increased slightly in northwestern California. The most common situation involved single overmature trees which were often under additional stress from heavy stocking or old injuries. Concentrations of ponderosa pine mortality occurred only on McCloud Flats around established blackstain root disease centers, and on some hot, dry, brushy areas that were of minimum commercial site quality.

In Siskiyou County, ponderosa pine mortality was locally pronounced on drier sites around Scott Valley and in the mountains between Fort Jones and Yreka. Western pine beetle and Ips paraconfusus were the predominant insects. Black stain root disease in the mountains, and dwarf mistletoe in general, served to predispose pines to attack in isolated spots. Improper slash treatment was a contributing factor at one location.

Western pine beetle activity and associated drought-related mortality increased relative to 1988 in mid- to lower-elevation pine and mixed-conifer stands in the central and southern Sierra Nevada Mountains. Mortality was particularly heavy on the Eldorado and Stanislaus National Forests and on the Mariposa District, Sierra National Forest, and extended through Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, Mariposa and Madera Counties. Increased pine mortality was also reported in the Greenhorn Mountains, Sequoia National Forest, Tulare County. Mortality commonly occurred in groups of from 10 to 50+ trees and involved pines from 12-14 inches dbh and larger. Yosemite National Park reported a total of approximately one million bd ft (800 trees) of mortality from western pine beetle; about 300,000 bd ft (300 trees) occurred in Yosemite Valley and primarily involved trees 30+ inches dbh. Overstocking and dwarf mistletoe were commonly associated with the group kills, but three consecutive years of below normal precipitation continues to be the most significant predisposing factor.

West and northwest of Big Valley in Lassen and Modoc Counties, pockets of concentrated ponderosa pine mortality were noted in the vicinities of Widow Mountain, Jimmerson Mountain, Egg Lake, and Timber Mountain.

Hundreds of ponderosa pines were attacked in the Angwin area of Napa County. Tree mortality also was concentrated north of Violet Spring, Mendocino National Forest, Lake Co. Scattered ponderosa pine were killed in other areas of Napa, Lake and Mendocino Counties.

In southern California, bark beetle attacks and mortality became more common as the drought persisted. Western pine beetle, red turpentine beetle and pine engravers were active on Figueroa Mountain, Los Padres National Forest, Santa Barbara County. Large Coulter pine and young ponderosa pine were attacked.

Levels of mortality remained unchanged in the San Bernardino Mountains from the main divide to the Angeles National Forest. The situation around Arrowhead was about normal, but a pocket kill occurred in the North Bay-Voltone area of Lake Arrowhead, San Bernardino County. However, the area containing mortality

doubled around Idyllwild. The chapparrel-conifer interface was the zone most heavily impacted. Beetle activity is now moving from the Coulter pine into the Jeffrey pine at higher elevations.

Stands of Coulter pine on or near lands of the Palomar District, Cleveland National Forest, San Diego County, have incurred considerable mortality from attacks by the western pine beetle and pine engraver beetles, Ips spp. Damaging attacks on private parcels and district recreation sites occurred along County Highway S-7 (East Grade Road, San Diego County). Extensive mortality occurred in the Agua Tibia Wilderness, Palomar Mountain State Park, and in the vicinity of Morgan Hill, Lost Valley and Julian-Pine Hills. Mortality from bark beetles may be contributing to a type conversion in the area from Palomar to Julian.

Beetle activity around Mt. Laguna, San Diego County, is somewhat less, but some pockets of activity persist.

PINE ENGRAVER BEETLES, Ips spp. Damage caused by pine engravers was higher than normal, but widely scattered in the northern part of the State. Pine engravers were often associated with attacks by the western pine beetle and mountain pine beetle. By late summer, scattered Digger pine and small groups of knobcone pine killed by pine engravers were beginning to fade. Some of the ponderosa and sugar pine damaged by blowdown during December, 1988 became heavily infested with pine engravers during the summer of 1989. It will be late in 1989 or early 1990 before mortality caused by emerging broods becomes evident.

Pine engraver activity continued at above normal levels for the third consecutive year in pine and mixed conifer stands of the Sierra Nevadas from Nevada to Madera Counties. Pine engravers were often associated with western and mountain pine beetle infested trees, but in many cases, Ips alone killed more than 50% of the crown or caused the death of ponderosa pines, particularly in stands below 4,000 ft elevation. Ips, along with flatheaded borers, also were active in Alpine County in stands of Jeffrey pine consisting of sapling, pole and small sawtimber (Carson District, Toyiabe National Forest).

Pine engravers were involved in mortality of several scattered and large groups of Monterey, ponderosa, and knobcone pine in Santa Clara, Alameda, Mendocino, Napa, Lake, and Santa Cruz Counties. Ips paraconfusus and I. mexicanus were subsequent associates of attacks on Monterey pine by the red turpentine beetle in Santa Cruz County. Ips also caused top-kill of ponderosa pine at Boggs Mountain State Forest in Lake County.

Near Crestline, San Bernardino County, pine engravers attacked large pines more effectively than usual, often from top to stump level. Mortality often was brought about by the combined effects of several bark beetles. New building construction with felled slash contributed to the significant increase of pine engravers at Angeles Oaks in San Bernardino County. In addition, pine engravers, probably Ips confusus, attacked pinyon pine stands near Baldwin Lake east of Big Bear (San Bernardino County). These drought-stressed, overstocked stands also contain pockets of black stain root disease that contribute to susceptibility.

Pine engravers played a prominent part in the top-kill and mortality northwest, west and south of Idyllwild, San Bernardino County. This group of bark beetles

also was involved in the extensive pine mortality over 2000 acres south and southeast of Mt. Palomar, and north of Julian, San Diego County.

FIR ENGRAVER, Scolytus ventralis. Mortality of red and white fir was extensive in the true fir types in northern California. The fir engraver, as well as Scolytus subscaber, S. praeceps, and the fir roundheaded borer, Tetropium abietinum, were all involved. Dwarf mistletoe was associated with these insects in fir mortality and branch killing on the Klamath National Forest, Siskiyou County. The fir engraver alone was responsible for substantial mortality of overstocked, drought-stressed white fir in eastside pine stands. Mortality of white fir in mixed conifer stands is slightly higher than normal, but still scattered.

Aerial survey by the California Department of Forestry and Fire Protection showed the extent of drought-related true fir mortality in Plumas and Lassen Counties. Pegleg Mountain in southern Lassen County marked the northern extent of most of the mortality, although some scattered mortality exists further north. In Plumas County, mortality is heavy from Indicator Peak, Wheeler Peak, and Mount Ingalls east, but is light to the west of these peaks. A road survey between Beckwourth and Susanville revealed extensive mortality in all stands containing true fir.

Overstory white fir were killed in the West Prospect Spotted Owl Habitat Area, Hat Creek R.D., Lassen National Forest. Mortality was associated with other pests -- root disease, dwarf mistletoes, and cytospora canker. White fir mortality was high in some stands on the Blacks Mountain Experimental Forest, also on the Lassen National Forest. These stands were 80+% pine with dense white fir clumps and occurred on low quality sites that had been through three years of drought. About 10% of the white fir population over 10,800 acres was affected. Farther north and east, S. ventralis caused top and branch kill of white fir in the Cedar Pass Campground, Modoc National Forest, Modoc County, where diseases and adverse stand condtions provided opportunities for successful attack.

The fir engraver continued to be associated with above normal fir mortality in mixed conifer and true fir stands throughout the Sierra Nevada. Particularly hard hit were stands on the Tahoe, Eldorado, and Stanislaus National Forests, and the Kings River District of the Sierra National Forest, and in the counties of Nevada, Sierra, Placer, El Dorado, Alpine, Amador, Calaveras, Tuolumne, Mariposa, Madera, and Fresno. Fir stands also were heavily affected in the Lake Tahoe Basin and the Breckenridge area of Kern County (south of Lake Isabella, Sequoia National Forest). Attacks by this beetle were associated with annosus root disease and cytospora canker in red fir at the Alpine Ski Area, Placer County.

Engraver infested fir were often characterized by severe pitch streaming along the bole well before crown fade became evident. This was particarly evident in the severe mortality that occurred in the 23-year-old white fir provenance plantation at Camino, El Dorado County, a site visited by attendees at the insect committee field meeting (Fig. 2).

Scattered white fir mortality was observed in interior portions of the coastal region. Beetle attacks were noted following timber activities in southern Humboldt County. Group kills of grand fir were found in an annosus root disease center in Jackson Demonstration State Forest, Mendocino County.

Figure 2. White fir killed by the fir engraver, Camino, Ca. Live trees occur at the left margin of the photo. (Photo courtesy of J. W. Dale).

In southern California, this engraver, along with flatheaded borers, attacked white fir near Lake Arrowhead, and killed branches in tops of overstory firs in the area surrounding Green Valley Creek, San Bernardino Co.

RED TURPENTINE BEETLE, Dendroctonus ventralis. This beetle played a role in the scattered mortality of old growth ponderosa and sugar pines in northern California, particularly Mendocino and Lake Counties. In some cases the trees attacked by red turpentine beetle were under enough moisture stress that only small amounts of dry, granular frass were produced. For example, some attacks of red turpentine beetle and pine engravers on ponderosa pine were associated with wet meadows sites that had dried. The beetle also was quite active in residual pines in areas that burned in 1987, although some of the attacks were not successful. These unsuccessful attacks on scorched trees may have been the result of copious resin flows. Some residual trees had little competition for soil moisture following fire because most of the surrounding vegetation had been eliminated.

The number of trees attacked by this beetle increased considerably throughout the central and southern Sierra Nevada in 1989. Attacks were often associated with western and mountain pine beetle infested ponderosa and sugar pines. Attacks frequently reached a height of 6-12 ft above the root collar, and, in some situations, red turpentine beetles were the sole mortality factor for drought-stressed trees.

Attacks of the red turpentine beetle were widespread on living trees in Santa Cruz County, and it appeared to be the primary cause of tree mortality.

Attacks by Ips paraconfusus and I. mexicanus on the main stem of the tree typically followed attacks by the red turpentine beetle.

In addition to Santa Cruz, hundreds of Monterey pine were attacked in Santa Clara, Alameda, Lake, Napa and Monterey Counties. Attacks in Monterey County often were associated with pines damaged by house construction. Scattered mortality occurred in Monterey and ponderosa pine located in Sonoma, Marin and Solano Counties.

FIR FLATHEADED BORER, Melanophila drummondi. Evidence of fir flatheaded borer was extremely abundant in northern California because of several situations. Several consecutive dry winters have allowed the fir flatheaded borer, along with the Douglas-fir engraver (Scolytus unispinosus), canker fungi, and twig weevils, to cause considerable Douglas-fir mortality in the major river drainages. Although the visual impact is large, much of the mortality will not be salvaged for a variety of reasons. Fir flatheaded borer was also found infesting residual Douglas-fir that survived the fires of 1987. Many of the infested trees had enough thermal cambial damage that death was inevitable. Fir flatheaded borer also commonly infested Douglas-fir involved in extensive blowdown (Figure 3) caused by a storm in December of 1988 in Humboldt, Trinity, Mendocino, and Siskiyou Counties. In many cases, all available cambium in the fallen trees was occupied by borer larvae.

Figure 3. Damage to red fir caused by high winds in December 1988, Grasshopper Ridge near Timber Camp, Salmon River Ranger District, Klamath National Forest, Siskiyou County . (USDA-FS photo courtesy of Gregg DeNitto)

Douglas-firs growing in association with ponderosa pine and Oregon white oak exhibited evidence of repeated attacks by this and other borers near Fort Jones (Siskiyou County). Resin streaming from attacks was common on living and recently killed trees, along with numerous older attacks, overgrown with callus.

This borer was often associated with the fir engraver in the extensive mortality of true firs found on eastside sites from southern Lassen County to Lake Tahoe. Larvae of the fir flatheaded borer were common in logs salvaged from true firs dead for one year in eastside timber stands in Plumas and Lassen Counties.

MOUNTAIN PINE BEETLE, Dendroctonus ponderosae. Scattered old growth sugar pine have been killed throughout the northern part of the state by a combination of drought stress and mountain pine beetle attacks. Sugar pine mortality is particularly apparent on parts of the Happy Camp Ranger District, Siskiyou County. Several older grafted, rust resistant sugar pine were killed at the outplanting site near Happy Camp by a combination of infections from the new race of blister rust, graft incompatibility, and mountain pine beetle attack.

Very high levels of mortality occurred from mountain pine beetle attacks on drought-stressed sugar pines located throughout the central and southern Sierra Nevada from Placer to Tulare and Kern Counties. Early mortality at Mountain Home Demonstration State Forest (Tulare County) was by red turpentine beetle, but later kills were by the mountain pine beetle. If drought persists, the mountain pine beetle may become an even greater threat in 1990.

In the Lake Tahoe Basin, the red turpentine and mountain pine beetle were involved in the mortality of large sugar pines. Light mortality in stands of lodgepole pine was reported from the Truckee-Lake Tahoe area, Alpine, Amador, and eastern El Dorado Counties; and the Twin Lakes Basin on the Mammoth District, Inyo National Forest, Mono County.

Scattered trees were attacked in Mendocino County and group kills occurred in southern Lake County. Most attacks were in sugar pine (< 12 inches bdh), but ponderosa pine (< 16 inches dbh) were also attacked.

Mountain pine beetle and Ips attacked stressed Coulter pine along the urban-rural interface and on marginal timber sites near Running Springs, San Bernardino County. Pockets of 10 to 20 sugar pine were killed near Crestline, San Bernardino County.

CEDAR BARK BEETLES, Phloeosinus spp. Incense-cedar mortality was widespread and much higher than normal in northern California. Much of the mortality was in smaller, suppressed trees, although some larger size classes were also involved. Dead incense-cedar were particularly noticeable in some of the campgrounds around Clair Engle Lake in Trinity County, and along the upper Trinity River.

Dead and dying incense-cedars were reported from locations throughout the Sierra Nevada from El Dorado to Tulare County. Mortality was particularly heavy in the Lake Tahoe region and in the vicinity of the Oakhurst Basin, Mariposa County. Cedar also was attacked in Calaveras County in the vicinity of Railroad Flat. Virtually all size classes of cedars and trees growing in a

wide variety of site and stand conditions were affected. Cedar bark beetles, woodborers, and needle, bud and twig moths (Argyresthia sp.) were found associated with some of the affected trees, but no single causal factor was identified with mortality or decline.

A cedar bark beetle was associated with several spots of Port-Orford-cedar mortality in Shasta and Siskiyou Counties. Possible contributing factors include drought stress, alteration of water flows by construction, injury from previous logging, and a buildup of beetles in slash created by logging or road maintenance. Port-Orford-cedar root disease was not involved in mortality in these spots.

ROUNDHEADED FIR BORER, Tetropium abietis. This beetle was the most abundant borer found in logs cut from true fir dead for one year in eastside true fir stands in Plumas and Lassen Counties. It was associated with fir engraver in the extensive mortality of eastside sites from southern Lassen County to Lake Tahoe.

CALIFORNIA FLATHEADED BORER, Melanophila californica. Jeffrey pine weakened by drought and human activity were killed by the borer in the Wrightwood area, San Bernardino County. This flathead also occurred, along with western pine beetle, in dead and dying ponderosa pine in Mendocino County.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. Individual and small groups of Douglas-fir were killed in Mendocino, Lake, and Humboldt Counties. Populations were noted in down material in Siskiyou and Santa Cruz Counties.

DOUGLAS-FIR ENGRAVER, Scolytus unispinosus. Scattered pole-size Douglas-firs were killed or top-killed on drier sites in Mendocino, Lake, Humboldt, Del Norte, and southwestern Trinity Counties. Mortality levels were lower than in 1988.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi. Above normal levels of Jeffrey pine beetle activity, mostly in individual or small groups of trees, were reported from Alpine, Placer, Nevada, and Sierra Counties, northern Mono County, and eastern El Dorado County. The Jeffrey pine beetle, along with pine engravers, also attacked stressed trees in and near Big Bear, San Bernardino County.

DOUGLAS-FIR TWIG WEEVIL, Cylindrocopturus furnissi. Scattered Douglas-firs were infested in coastal areas. Most branches and tops were of small diameter (< 1 inch). After two successive years of increasing weevil injury, branch flagging seemed to be less in 1989 than in preceeding years.

TWIG BEETLES, Pityophthorus spp. Numerous pines were attacked in Santa Clara, Santa Cruz, Sonoma and Mendocino Counties. Most attacked trees were previously subjected to one or more sources of stress.

EUCALYPTUS LONGHORNED BORER, Phoracantha semipunctata. This Australian native was found in three counties in the Bay Area in 1989 -- apparently new county records for this borer. In Alameda County, two larval collections were made from Eucalyptus in Fremont parks in February, and two larval collections were made in Newark in March. A larva originally identified as Phoracantha sp. was collected from the Concord Naval Weapons Center, Contra Costa County. Larvae (Figure 4) and adults (Figure 5) were collected in July on the estate of Stanford University, Santa Clara County. All southern California counties are now infested.

Figure 4. Larval mines of the Eucalpytus longhorned borer upon the inner bark surface. (CDF&FP photo courtesy of Sherby Sanborn)

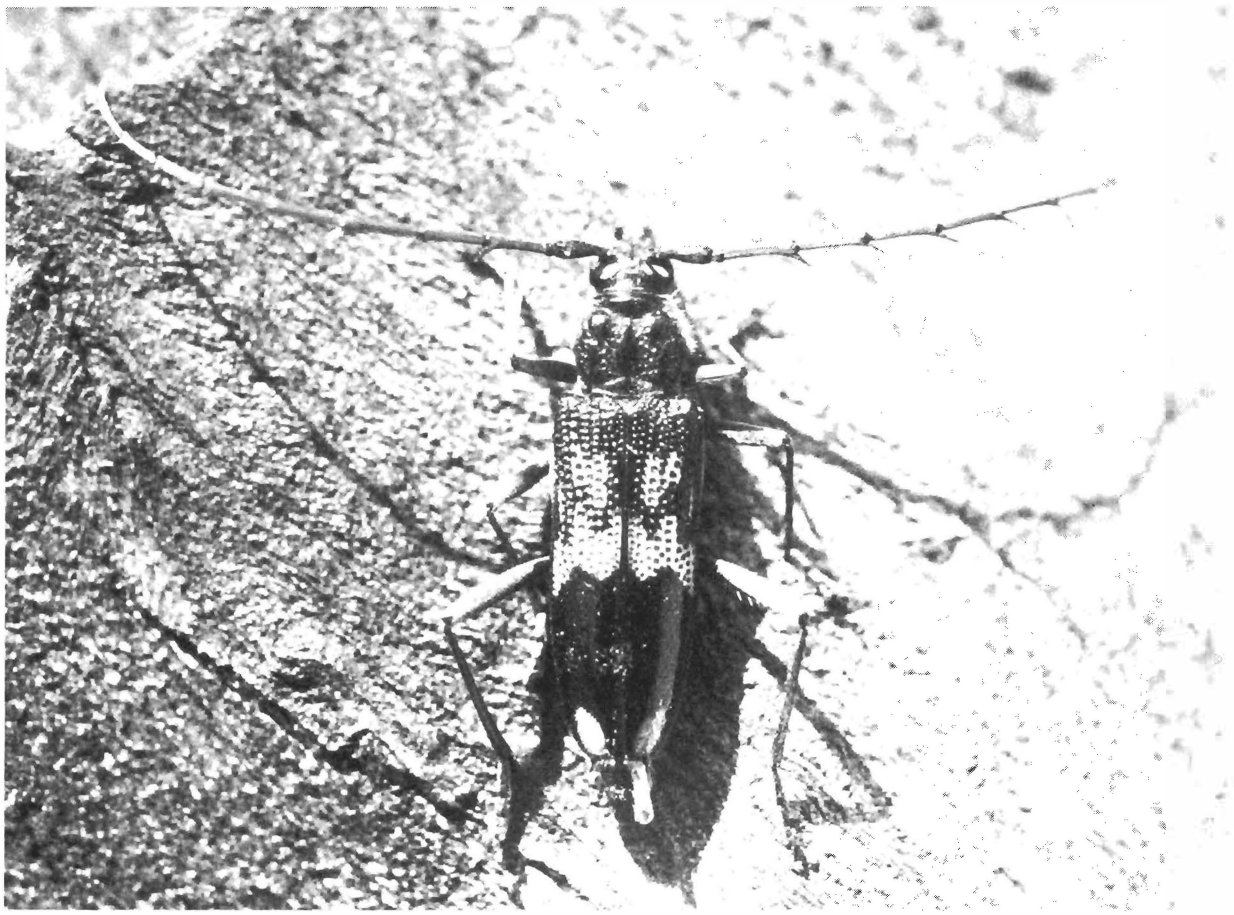


Figure 5. Adult eucalyptus longhorned borer at rest on bark. (CDF&FP photo courtesy of Sherby Sanborn)

The California Department of Forestry and Fire Protection is entering into an agreement with the Department of Entomology at the University of California, Riverside, which will provide the following: 1) an optimized trap baited with synthetic chemicals, 2) a trapping schedule, 3) an estimate of the effects of winter temperatures on the spread into northern California, 4) an analysis of the chemical factors which make some eucalyptus species attractive to the beetle, and others less so, and 5) an analysis of the pheromone chemistry of the insect and the potential for using pheromone based technology for control.

A SCARAB BEETLE, Dichelonyx sp. Ponderosa pine seedlings planted in 1988 after the Lost Fire (Lassen N.F., Shasta County) were severely defoliated by this scarab. It is thought that when the fire occurred, the beetles were in the larval stage in the soil, and thus unaffected by the fire. Upon emerging from the soil, the primary source of green vegetation on the site apparently were the seedlings.

A PINE NEEDLE WEEVIL, Scythropus sp. Light damage was observed on small planted and natural ponderosa and Jeffrey pines throughout the Tule River Ranger District, Sequoia National Forest. The top third of the crown of 30 to 50 sugar pines were damaged at Badgerhill Seed Orchard, Eldorado County. This

weevil also caused some damage to plantation pine seedlings heavily damaged by Dichelonyx (backi ?) (Lassen National Forest, Shasta County).

DOUGLAS-FIR TUSSOCK MOTH, Orgyia pseudotsugata. Approximately 600 acres of light Douglas-fir tussock moth defoliation was reported in late fall of 1988 in the vicinity of Baltic Ridge on the Placerville District, Eldorado National Forest, El Dorado County. Defoliation was limited to understory white fir and the tops of overstory fir. Subsequent evaluation found very low populations and no additional feeding injury in 1989. The population apparently started to increase at about the same time as the epidemic populations in Plumas County, but declined naturally without causing unacceptable damage.

Farther north, in parts of Plumas, Lassen, Tehama and Sierra Counties, the tussock moth outbreak detected in 1987 increased to approximately 105,000 acres. In order to reduce tree mortality and other types of damage associated with defoliation, the USDA-Forest Service, California Department of Forestry and Fire Protection, and private land owners entered into a cooperative agreement to treat much of the outbreak with the biological insecticide Bacillus thuringiensis. In late June of 1989, nearly 84,000 acres, including 6,969 acres of privately-owned land, were treated. A post treatment evaluation confirmed the project's success; populations of the moth were reduced by all factors by an average of 90% and severe defoliation was prevented. Surveys for egg masses indicate that continuation of the infestation is unlikely.

A lone larva was occasionally found on Bonanza King Mountain, Weaverville District, Shasta-Trinity National Forest, Trinity County.

GYPSY MOTH, Lymantria dispar. The following information was provided to the annual meeting of the California Forest Pest Council by Don Henry, Branch Chief, Pest Detection/Emergency Projects, Division of Plant Industry, California Department of Food and Agriculture.

"The California Gypsy Moth Program - 1989"

"The California Department of Food and Agriculture maintains a statewide detection program for gypsy moth using trap densities of two traps per square mile in most residential and densely populated rural areas, and three traps per square mile in urban areas with high numbers of familes moving from gypsy moth infested areas of the northeast. High risk sites such as campground, recreational areas, mobile home parks, etc., are trapped at a minimum of one trap per site. Upon catching an adult gypsy moth, trap density is increased to 25 traps per square mile in a four-square-mile area around the find. During 1989 this detection and delimitation system caught 33 gypsy moths in 12 counties spread from San Diego to Cottonwood (Shasta County). As of August 31, 1989, there were approximately 21,000 gypsy moth traps in place throughout California" (Table I).

"In addition, incoming moving vans from gypsy moth infested areas of the East have their contents inspected upon arrival at their destination. If there are any signs of live gypsy moth eggs, larvae, or pupae, 25 traps are deployed in a square-mile area around the move-in site. If spent pupal cases and old egg masses are recovered, then a single trap is placed on the property. Quarantine

traps caught 23 gypsy moths in 1989 in three counties, with the majority (15) coming from the City of Tiburon in Marin County" (Table II).

"In total, 56 adult gypsy moths were captured in 14 counties, with the greatest number coming from Marin County (25) and San Diego County (8). Egg mass surveys, conducted around all multiple trap catches, found egg masses at single sites in Marin and Placer Counties. A limited treatment program using either Dimilin or **Bt** (Bacillus thuringiensis) from the ground is being planned for these locations in 1990. The source of infestation for both the Marin and Placer County sites have been specifically identified to residents arriving in 1988 from high hazard areas in the Northeastern U.S."

"Trap densities of 25 traps per square mile over a four-square-mile area will be maintained around all single moth capture sites for 1990."

TABLE I. CALIFORNIA GYPSY MOTH SITUATION - 1989[a]

Years	Traps Placed	Adults Trapped	Counties	Properties with Viable Egg Masses/ Pupal Cases	Sites Treated
1984	30,000	25	9	2	5
1985	28,000	28	10	3	2
1986	27,000	20	9	1	0
1987	19,000	6	5	1	1
1988	20,000	13	6	0	0
1989	21,000	56	14	2	0

a. As of September 6, 1989.

TABLE II. LOCATION OF GYPSY MOTHS CAUGHT IN CALIFORNIA IN 1989

County	City
Alameda	Berkeley (2)
Los Angeles	Chatsworth, Newhall, Sun Valley, Woodland Hills (1 each)
Marin	Fairfax (2), Novato (1), San Rafael (3), San Anselmo (2), Tuburon (17)*
Nevada	Grass Valley (3)
Orange	Anaheim, Fullerton (1 each)
Placer	Roseville (3)*
Sacramento	Carmichael (1)
San Diego	La Mesa (7), Valley Center (1)
San Joaquin	Manteca (1)
San Mateo	Menlo Park (1)
Santa Clara	San Jose (1)
Shasta	Cottonwood (2)
Tuolumne	Sonora (1)
Ventura	Thousand Oaks (2)

(#) Number of adult moths trapped.
* One property with viable egg masses/pupal cases.

Movement of the gypsy moth from Oregon to California now seems unlikely. Only two gypsy moths were detected in Oregon in 1989. This is the fewest caught in the state since 1979, the first year gypsy moths were caught in Oregon. The two moths were caught two miles apart in Eugene, Lane County. No gypsy moths were caught in Lake Oswego, where two small ground sprays of B. thurengiensis were applied in May 1989. Furthermore, no gypsy moths were caught in Josephine County, where an aerial application was made in 1988; and for the third year in a row, gypsy moths were not caught in Douglas County. No eradicative spray applications (ground or aerial) are planned for gypsy moth in 1990.

Gypsy moth quarantines are not in effect anywhere in Oregon. State and Federal gypsy moth quarantines in Lane County were removed in April and July 1989, respectively.

Final figures indicate about 22,250 gypsy moth traps were placed statewide in Oregon. This is down from the over 32,000 traps placed in 1987 and 1988, and reflects the success of the eradication projects in combination with the detection and delimitation trapping programs. The trapping program in Lane County (about 12,000 traps) was a cooperative effort among the Oregon Department of Agriculture, Oregon State Department of Forestry, and the USDI Bureau of Land Management.

Gypsy moth survey and detection traps were concentrated in western Oregon. The standard survey trap density was 1-4 traps/mi^2. Trap densities of up to 16-49 traps/mi^2 were placed in areas of previous detections. An area of Lake Oswego was mass trapped at 3-9 traps/acre. All areas of Lane County were gypsy moths have been caught since at least 1986 were trapped at 16 traps/mi^2.

In the eastern United States, a new nuclear polyhedrosis virus lethal to gypsy moth was found in Abington, MA. A fungus, Entomophaga sp., killed larvae in Connecticut in the spring of 1989, a period of exceptionally high precipitation levels.

NANTUCKET PINE TIP MOTH, Rhyacionia frustrana. The status of this insect apparently remains unchanged from 1988 -- the range of this introduced insect remains Alameda, Fresno and Santa Cruz Counties in the north, and Kern, Orange, San Bernardino and San Diego Counties in southern California.

PACIFIC TENT CATERPILLAR, Malacosoma constrictum. Overwintering egg masses were quite common on Quercus spp., particularly blue oak (Q. douglasii), in the northern Sacramento Valley, Shasta County. However, egg parasitism was high and larval survival was low. Populations have collapsed and defoliation was minor to virtually undetectable.

TENT CATERPILLAR, Malacosoma sp. Tent caterpillar populations on antelope bitterbrush in Inyo and Mono Counties remained at low levels in 1989. Feeding injury was only noted on scattered, individual plants. The outbreak collapsed in 1988 without causing significant mortality to bitterbrush subjected to three to four years of heavy defoliation.

BALSAM TWIG APHID, Mindarus abietinus. Studies of suppression techniques applicable in beds of true fir seedlings continued at the Placerville Nursery.

WHITE FIR NEEDLEMINER, Epinotia meritana. Severe defoliation was reported in the spring at three locations on or near the Kings River Ranger District, Sierra National Forest -- Hofman Mountain, Tule Meadow, and the Three-springs Rancheria.

A CALIFORNIA SPRUCE BUDWORM, Choristoneura carnana californica. This defoliator of Douglas-fir has remained at low levels since the end of the Trinity County outbreak in 1985.

CALIFORNIA OAKMOTH, Phryganidia californica. Infestations in tanoak declined from the 1988 level in Jackson Demonstration State Forest, Mendocino County. A large oakmoth population and extensive defoliation of live oak were noted in Henry Cowell Campground, Santa Cruz County.

CUTWORMS, Euxoa sp. and Agrotis ipsilon. Euxoa (perexcellens?) again caused mortality to container stock planted as part of a 47-acre revegetation project for a hydroelectric site near Tule Meadow on the Kings River District, Sierra National Forest, Fresno County. Damage was unevenly distributed within the area and mortality was again estimated at about 10-20% of the total planting. Damage was greatest to true fir planted in the fall of 1988 to replace seedlings killed earlier in the year.

The black cutworm, Agrotis ipsilon, killed 1-0 Douglas-fir and Jeffrey pine seedlings in four beds at the Humboldt Nursery, Humboldt County. Control was obtained with an application of diazinon.

CONIFER APHIDS, Cinara spp. Aphids were rumored to be abundant in 1989. More specifically, these aphids caused heavy exudation on white firs of all size classes in stands on the Beckwourth District, Plumas National Forest, Plumas and Sierra Counties. Honeydew on these white fir was so heavy that it glazed the litter under the trees and created a heavy layer on the foliage specimens collected by foresters. Conifer aphids were also very abundant on ponderosa pine at the Chico Tree Improvement Center, where the honeydew from the aphids caused many trees to take on a varnished appearance. Conifer aphids also occurred early in the spring at Humboldt Nursery, but never became a problem.

CONE AND SEED INSECTS. Unknown species caused a noticeable decline in cone crops in Sonoma County. Flowers at Badgerhill Seed Orchard, El Dorado County, were damaged in early or mid-spring by insects that were no longer present when the damage was observed in mid-June.

Coneworms, Dioryctria sp., were abundant in red fir cones shipped to the Placerville Nursery. Seed maggots in fir cones appeared to be less abundant than in 1988. However, seed worms, Cydia (Laspeyresia) spp., seemed more common in 1989 shipments of ponderosa and Jeffrey pine cones than in 1988.

Three species of coneworms have been identified at the Chico Tree Improvement Center, Butte County. Dioryctria cambiicola and D. baumhoferi were collected in pheromone traps in Afghanistan and ponderosa pine seed orchards. The fir coneworm, Dioryctria abietivorella, was reared from the limited production of Douglas-fir cones. This species could cause considerable damage to Douglas-fir

crops once the trees have begun to produce large numbers of cones. Losses of pine conelets to coneworms remain steady at about 6% of the crop. Abortion of large numbers of pine conelets remains unexplained.

INSECTS AT HUMBOLDT NURSERY. Mortality of red fir seedlings in the winter of 1988-1989 lead nursery personnel to collect larvae that when reared, proved to be the vegetable weevil, Listioderes obliquus. Collections by Forest Pest Management resulted in adults of the black vine weevil, Otiorhynchus sulcatus. These weevils have the potential to do serious damage in the nursery and preparations were made to treat the beds with a parasitic nematode, Steinernema feltiae. However, the number of weevils declined and treatment will occur only when a population sufficient for analysis is present.

Other weevils collected from fallow nursery units were the strawberry root weevil, Otiorhynchus ovatus, and the clover root curculio, Sitona hispidulus. These and the other weevils in fallow units should be amenable to cultural controls, such as plowing when the insects are in the delicate pupal stage.

Nursery personnel are gradually becoming the pest detecting sensors of the nursery. The following is a partial list of insects collected by personnel who lift seedlings, weed, and do other physical jobs in the beds:

Byrrhidae	Amphicyrts dentipes, a pasture pill beetle
Noctuidae	Agrotis ipsilon, black cutworm
Carabidae	Scaphinotus sp., Agonum sp., Pterostichus sp., beneficial ground beetles
Aphidae	Rhizomania sp., or possible Prociphilus sp., nymphs on roots of Douglas-fir seedlings
Braconidae	Meteorys sp., cocoons attached to seedling roots
Tachinidae	Compsilura concinnata, reared from pupae of Halisidota maculata

EUROPEAN PINE SHOOT MOTH, Rhyacionia buoliana. A possible increase in the population in Oregon has heightened vigilance against the shipment of uncertified nursery stock into California.

ASH WHITEFLY, Siphoninus phillyreae. This insect was introduced into southern California and has been found as far north as Sacramento. It will continue to create problems with ornamental trees and shrubs throughout the area as spread and populations rapidly increase. The Department of Food and Agriculture and entomologists at the University of California, Riverside are participating in an all-out effort to identify, collect, import, test, reproduce, and release parasites and/or predators to effect an acceptable level of biological control.

TABLE IV. INSECTS OF LESSER IMPORTANCE IN CALIFORNIA - 1988

INSECTS			WHERE EXAMINED OR REPORTED	
Scientific Name	Common Name	Host	County	Remarks
Agrilus burkei	A buprestid beetle	AL	Marin Napa Sonoma	General damage.
Agromyzidae	A leaf-mining fly	BO	Mendocino Sonoma Napa	Galls on main veins caused defoliation in heavy infestation, west side of Rt. 101, Hopland to Ukiah, CA.
Altica ambiens	Alder flea beetle	WA	Siskiyou	Defoliated alder on Salmon River R.D.
	Ambrosia beetles	WF RF	Lassen Plumas	Common in dead firs, eastside habitat.
Andricus sp. and Dryocosmus sp.	Gall wasps	LO	Tulare	Common on twigs and leaves; some oaks completely defoliated
	Aphids/ adelgids	SS	Humboldt	Infestations remain static on sitka.
		DF	Sonoma	Scattered Christmas tree lots in Sebastapol, Sonoma County.
	Cedar wood borers	IC	Siskiyou	Infested dying trees with drought stress.
Cicada sp.	Cicada	DF	Mendocino Humboldt	Decreased oviposition wounding from highs of 1987 and 1988.
Cheilosia sp.	Bark maggot	WWP	Shasta	Infested wounds caused by sapsuckers on Latour St. Forest.
Chrysobothris mali	Pacific flat-headed borer	HD	Sonoma	Various host species.
Cryptorhynchus lapathi	Poplar-and-willow borer	PO	San Bernardino	Landscape hybrid poplars.
Cydia cupressana	Cypress bark moth	ICP	Santa Barbara	Ornamentals.
Diabrotica undecimpunctata	12-spotted cucumber beetle	DF RF	Humboldt	Common on seedlings in Humboldt Nursery.

TABLE IV. (Cont.)

INSECTS			WHERE EXAMINED OR REPORTED	
Scientific Name	Common Name	Host	County	Remarks
Dioryctria sp.	A shoot borer	DF	Butte	Mined terminal and lateral shoots of Christmas trees under moisture stress.
Halisidota maculata	Spotted tussock moth	DF	Humboldt	Infrequently found on nursery seedlings.
Hexomyza schineri	An agromyzid gall maker	AS	Plumas	Potato-like galls on twigs.
Neodiprion sp.	A pine sawfly	LP	Modoc	Big Valley District, Modoc National Forest
Neophasia menapia	Pine butterfly	PI	El Dorado Tuolumne	Flying adults common.
Nuculaspis californica	Black pineleaf scale	SP	Modoc	Tops of trees on the north slope of Jimmerson Mountain are heavily infested.
Nymphalis californica	California tortoise-shell	CE	Trinity	Defoliated brush on Hayfork R.D.
Orgyia antiqua	Rusty tussock moth	DF	Humboldt	Infrequently found on nursery seedlings.
Phloeosinus sequoiae	Redwood bark beetle	RW	Marin Mendocino	Group kills occurred in marginal redwood areas.
Phryganidia californica	California oakworm	LO TO	Santa Cruz; Mendocino	Nuisance in Cowell campground; population declined in Jackson Demonstration State Forest
Platynota stultana	Omnivorus leafroller	WF SP	Butte, Humboldt	Present at Chico Tree Improvement Center, and Humboldt Nursery.
Pseudohylesinus nebulosis	Douglas-fir pole beetle	DF	Siskiyou	Associated with trees with black stain root rot.
Pseudopityop-thorus sp.	Oak bark beetles	OA	Tuolumne	Common on drought-stressed trees.

TABLE IV. (Cont.)

INSECTS			WHERE EXAMINED OR REPORTED	
Scientific Name	Common Name	Host	County	Remarks
Scolytus praeceps	A fir engraver	DF	Butte	Moisture-stressed Christmas trees on a ponderosa pine-black oak site.
Vespamina sequoiae	Sequoia pitch moth.	MP	Coastal counties, Mendocino to Monterey.	Chronic, particularly from San Francisco to Monterey County, and possibly southward.
Zellaria haimbachi	Pine needle-sheath miner	JP	Tulare	Planted and natural trees on Tule River Ranger District.
Xyela sp.	A primitive sawfly	LP	Mono	Recreation nuisance.

HOST ABBREVIATIONS

AL = Alder
AS = Aspen
BO = Black oak
CE = Ceanothus sp.
DF = Douglas-fir
HD = Hardwoods
IC = Incense-cedar
ICP = Italian cypress
JP = Jeffrey pine
LO = Live oak
LP = Lodgepole pine
MP = Monterey pine
OA = Oaks
PI = Pine
PO = Poplar
RF = Red fir
RW = Redwood
SP = Sugar pine
SS = Sitka spruce
TO = Tanoak
WA = White alder
WF = White fir
WWP = Western white pine

STATUS AND CONTROL OF DISEASES

ABIOTIC DISEASES. Damage to a variety of conifer and shrub species was caused by deicing salt along several highways in northern California. Damage was most severe in the Lake Tahoe Basin, with vegetation affected along interstate 80 from Alta to the Nevada border, Highway 20 from Nevada City to I-80, and Highway 89 north of Truckee to Sierraville. Damage was also apparent along Highways 267, 28, and 50 (Placer, El Dorado Counties). Beyond the Lake Tahoe Basin, the most obvious areas were along Interstate 5 from Castella north to Weed and on Highway 89 from Interstate 5 east beyond McCloud (Siskiyou County).

Severe spring frost damaged Eucalyptus from the Bay Area north into Mendocino County.

FOLIAGE DISEASES. Elytroderma needle disease (caused by Elytroderma deformans) was reported on ponderosa pine in natural stands on the Covelo Ranger District, Mendocino National Forest (Mendocino County).

Scorch of bigleaf maple was quite apparent in many areas of northwestern California. The cause is undetermined, but the annual recurrence of this malady and the pattern of its occurrence suggest it is not caused by climatic factors as suggested in the past.

Douglas-fir needle cast (Rhabdocline pseudotsugae) infected less than five acres of Douglas-fir in Jackson Demonstration State Forest (Mendocino County).

Over 100 Monterey pine on the Jackson Demonstration State Forest (Mendocino County) were lightly to severely infected with Scirrhia pini, the cause of red band needle blight. The infestation is centered near Parlin Fork.

Ash anthracnose (Discula sp.) heavily infected trees in areas of Napa, Sonoma, and Mendocino Counties.

NURSERY DISEASES. Disease problems at Humboldt Nursery (Humboldt County) included: tip blight (Sirococcus strobilinus) deformed and killed 1-0 Jeffrey pine; gray mold, (Botrytis sp.) caused loss of lower foliage of held-over 1-0 Douglas-fir and tip dieback of redwood seedlings; cedar leaf blight, caused by Didymascella (Keithia) thujina, was responsible for foliage loss and mortality of 2-0 western red cedar; and Septoria sp. caused a leaf spot of white alder. Severe undercutting and overwatering contributed to the decline of 2-0 red fir, 2-0 Douglas-fir and 1-1 Douglas-fir transplants. A storage mold caused mortality of incense-cedar in bags stored at Happy Camp Ranger District, Klamath National Forest (Siskiyou County).

At Placerville Nursery (El Dorado County), Fusarium caused damping off of white and red fir germinants, and tip dieback and mortality of potted sugar pine growing in the greenhouse. The latter problem was seen in the Chico Tree Improvement Center (Butte County), where sugar pine seedlings are grown to test for white pine blister rust resistance at Placerville.

ROOT DISEASES. Black stain root disease, caused by the fungus Leptographium (Ceratocystis) wageneri, was found in several plantations of Douglas-fir on the

Hayfork Ranger District, Shasta-Trinity National Forests (Trinity County) and Lower Trinity Ranger District, Six Rivers National Forest (Trinity County). An infection center in a mature to overmature stand of Douglas-fir was found on Upper Lake Ranger District, Mendocino National Forest (Lake County). Mortality of ponderosa pine infected by black stain root disease occurred in a spotted owl habitat area on the east side of McCloud Flats, McCloud Ranger District, Shasta-Trinity National Forests (Siskiyou County). Ponderosa pine stands near Pondosa (Shasta and Siskiyou Counties) were identified as being infected. Many areas of Mendocino, Humboldt, and Del Norte counties continue to report black stain as a cause of thinning and regeneration problems for land managers. Black stain root disease also infected pinyon pine east of Baldwin Lake, Big Bear Ranger District, San Bernardino National Forest (San Bernardino County).

Infection centers of annosus root disease (Heterobasidion annosum) were found in ponderosa pine, sugar pine, and white fir in an area proposed for a tree improvement progeny test site on Crane Mills land (Tehama County). A disease center was detected in conjunction with fir engraver beetle attacks on grand fir in Jackson Demonstration State Forest, Mendocino County. Another center with infected ponderosa pine and incense-cedar was investigated on private property in Dunsmuir (Siskiyou County). White fir in Cedar Pass campground, Warner Mountain Ranger District, Modoc National Forest (Modoc County) and the Willow Creek timber sale, La Porte Ranger District, Plumas National Forest (Plumas County) are dying from annosus root disease. Ponderosa pine adjacent to Alandale Station, San Jacinto Ranger District, San Bernardino National Forest (Riverside County) are infected, as are Jeffrey pine in the Garner Valley area, San Jacinto Ranger District.

Port-Orford-cedar root disease (Phytophthora lateralis) remains limited to the Smith River drainage in California (Del Norte County), except for a few small infections on the Siskiyou National Forest (Siskiyou County). Newly infested areas that involved several hundred thousand board feet of mortality were identified along Packsaddle Creek, Diamond Creek, upper stretches of the Middle Fork Smith River, and Redwood Creek, Gasquet Ranger District, Six Rivers National Forest (Del Norte County). Local eradication of this root disease was attempted along a tributary of the Middle Fork Smith River near Sanger Peak. Merchantable trees were harvested and submerchantables were cut and, in some cases, grubbed from the site. Dead and dying Port-Orford-cedar at two sites near Happy Camp (Siskiyou County) were infested with Phloeosinus bark beetles, but were not infected with Port-Orford-cedar root disease.

Armillaria root disease (Armillaria spp.) decayed the roots of Douglas-fir and white fir sufficiently to cause windthrow of mature trees along a plantation boundary on the Orleans Ranger District, Six Rivers National Forest (Humboldt County).

CANKER DISEASES. The severity of pitch canker infections, caused by Fusarium subglutinans, appears to have declined in Santa Cruz County. However, pitch canker disease is continuing to spread from tree-to-tree in locations already identified as pitch canker zones. Some researchers report that in the course of their work they observed a large number of new infections on Monterey pine trees in both Santa Cruz and Monterey counties. Many new infections could not be seen from the ground and were evident only when observed from above the tree in a lift bucket.

Over one thousand Monterey pine are infected in the Santa Cruz area, with a lesser amount in the Hayward-San Leandro area. In Santa Cruz County, the

California Department of Transportation removed dead and dying Monterey pine. Many were also infested with pine engraver and/or red turpentine beetle.

New locations infested with pitch canker were found in Santa Barbara, Torrance, and Escondido. The infestation in Santa Barabara is on the coastal bluffs and involves 20 trees. Both the Torrance (Los Angeles County) and Escondido (San Diego County) infestations are in Christmas tree plantings and were presumably introduced through infested planting stock.

Increased levels of fire blight (Erwinia amylovora) in pears at Coffee Creek guard station, Shasta-Trinity National Forests (Trinity County) prompted a pruning operation to lessen the impact.

Phomopsis lokoyae and other unidentified fungi caused top kill and branch flagging in thousands of pole-sized and smaller Douglas-fir in drier areas of Sonoma County in 1988. Symptoms abated greatly in 1989.

Branch or tree mortality, caused by Fusicoccum sp., continues to occur on Madrone throughout northern California.

Redwoods in Jackson Demonstration State Forest and the town of Ukiah (Mendocino County) had branch cankers attributable to Seridium cardinale.

DWARF MISTLETOES, Arceuthobium spp. The abundance and distribution of dwarf mistletoes changes only gradually over time. Nevertheless, dwarf mistletoes are frequently a factor that leads to decline and mortality of infected trees. Such was the situation in 1989 when mortality and abundant branch flagging occurred frequently throughout the central and southern Sierra Nevada on red fir and white fir infected with dwarf mistletoe. Drought stress, attacks by Scolytus bark beetles, and infections of Cytospora abietis (cytospora canker) were contributing factors.

Arceuthobium campylopodum infested pockets of ponderosa pine in Boggs Mountain Demonstration State Forest, Lake County.

Three ponderosa and/or Jeffrey pine plantations on the Milford District, Plumas National Forest (Plumas County), that are representative of other plantations covering over 20,000 acres, were moderately to heavily infested with western dwarf mistletoe (Arceuthobium campylopodum).

Overstory and understory Digger pines were found to be moderately to heavily infested with dwarf mistletoe (Arceuthobium occidentale) in the Sunset Valley area, Santa Lucia Ranger District, Los Padres National Forest (Santa Barbara County).

AIR POLLUTION. Twenty-six ozone injury trend plots on the Sierra National Forest were visited in October 1989. These plots have been evaluated every two years since 1977. Ozone injury ratings are based on needle retention and foliar symptoms (chlorotic mottle) present on ponderosa and Jeffrey pines found between 4000 and 8000 feet elevation. Since last visited in 1987, injury ratings increased in five plots, decreased in 15 plots, and six plots were unchanged. All changes were minor. Overall injury levels remain in the light to moderate range.

Over the last two to three years, which coincides with general drought conditions, many pines in the southern Sierra Nevada have experienced a slight improvement in the amount of visible injury attributable to ozone. One explanation is that pines under drought stress are physiologically inactive for longer periods of time than normal and therefore, take up less air pollutants which results in reduced injury.

Favorable changes in ozone air quality in recent years coincide with visible improvement of crown condition at most forest monitoring plots in the San Bernardino Mountains (San Bernardino County). Observations are limited to the examination of ponderosa and Jeffrey pines as indicators of changes in exposure to ozone over time and space.

RUST DISEASES. Western gall rust (Endocronartium harknessii) induced branch flagging in Monterey pine from Marin to Humboldt County. In the Glen Ellen area of Sonoma County, approximately 600 acres of knobcone pine are infested with this fungus. A control burn may be conducted this winter to suppress the disease and reduce the fire hazard.

Infection levels of white pine blister rust (Cronartium ribicola) continue to be static in sugar pine throughout northern and central California. Many infections were noted near Mt. Sanhedrin (Mendocino and Lake counties).

Efforts to identify rust resistant sugar pine continue throughout California. Major gene resistant selections and candidate trees at Mountain Home Demonstration State Forest (Tulare County) and Latour Demonstration State Forest (Shasta County) were sprayed twice with Sevin 80S to protect against attack by mountain pine beetle and red turpentine beetle.

DUTCH ELM DISEASE. Dutch elm disease in California remains confined to the San Francisco Bay Area, with incidence in seven of the nine counties (Table III). The California Department of Forestry and Fire Protection detected and removed 207 diseased elms -- the smallest number of diseased elms detected in the quarantine area since 1984. In San Mateo county, this drop may be attributed to removal in 1988 of several root-grafted elms, plus reduced ability to sample high-hazard elms because of budget reduction in 1989. Over 60,000 properties and 150,000 elms were inspected by seasonal workers. The Forest Pest Management Laboratory in Santa Rosa processed 495 elm samples and identified diseases from a variety of other tree species.

TABLE III. NUMBER OF CONFIRMED TREES WITH DUTCH ELM DISEASE

COUNTY	1984	1985	1986	1987	1988	1989
Alameda	1	0	11	7	3	3
Contra Costa	29	21	30	35	35	34
Marin	71	154	125	83	91	82
Napa	3	2	3	2	9	5
San Francisco	0	0	0	0	0	0
San Mateo	54	63	44	47	70	48
Santa Clara	17	34	41	20	35	32
Solano	0	0	1	0	0	0
Sonoma	13	28	14	16	12	3
Total	188	302	269	210	255	207

TABLE IV. FOREST DISEASES REPORTED - 1989[a]

AGENT	HOST	COUNTY
ABIOTIC INJURIES		
Salt damage	DF,IC,JP,LP, PP,SP,WF	El Dorado, Placer, and Siskiyou
Cold temperature injury and winter drying	JP, PP	Nevada.
Mechanical injury	MH,RF,WWP	Placer
Overwatering	MA	Humboldt
CANKER DISEASES		
Fusicoccum sp.	MA	Humboldt
Phomopsis sp.	DF	Sonoma
Cytospora abietis	RF	Host range
Fusarium subglutinans	MP	Alameda, Monterey, Los Angeles, San Benito, San Diego, San Francisco, San Luis Obispo, Santa Barbara, Santa Cruz
Seridium cardinale	RW	Mendocino
Erwinia amylovora	PC	Trinity
FOLIAGE DISEASES		
Discula sp.	FV	Napa, Sonoma, and Mendocino
Elytroderma deformans	PP	Mendocino
Rhabdocline pseudotsugae	DF	Mendocino
Scirrhia pini	MP	Mendocino
Maple scorch	BM	Trinity, Shasta, and Siskiyou
NURSERY DISEASES		
Botrytis sp.	DF,RF,RW	Humboldt
Sirococcus sp.	JP	Humboldt

TABLE IV. (Cont.)

AGENT	HOST	COUNTY
NURSERY DISEASES		
Didymascella (Keithia) thujina	WRC	Humboldt
Severe undercutting & overwatering	RF	Humboldt
Fusarium sp.	WF	Humboldt, El Dorado
	RF	El Dorado
	SP	Butte, El Dorado, and Santa Cruz
Phoma sp.	DF	Humboldt
Phomopsis sp.	DF	Humboldt
Storage mold	IC	Humboldt and Siskiyou
Septoria	AL	Humboldt
PARASITIC PLANTS		
Arceuthobium spp.	PP	Lake and Plumas
	RF	Host range
	PS	San Luis Obispo
	JP	Plumas and Shasta
	WF	Modoc
	LP	Shasta
Phoradendron sp.	WF	San Bernardino
ROOT DISEASES		
Armillaria sp.	WF	Humboldt
	DF	Mendocino
Heterobasdion annosum	GF	Mendocino
	IC	Siskiyou
	JP	San Bernardino
	PP	Nevada, Plumas, Sierra, Siskiyou, San Bernardino and Tehama
	SP	Tehama
	WF	Placer, Plumas, San Bernardino, Tehama
	WJ	San Bernardino

TABLE IV. (Cont.)

AGENT	HOST	COUNTY
ROOT DISEASES		
Leptographium wageneri	DF	Del Norte, Humboldt, Lake, Mendocino, Siskiyou, Trinity
	PM	San Bernardino
Phytophthora lateralis	POC	Del Norte and Siskiyou
RUST DISEASES		
Cronartium ribicola	SP	Fresno, Lake, and Mendocino
Endocronartium harknessii	MP	Humboldt
	KP	Sonoma

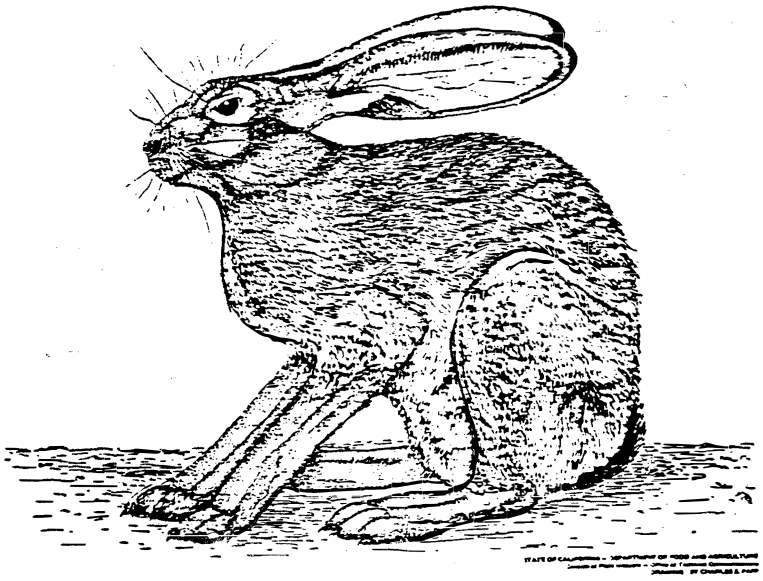
a. Not a complete listing for all locations reported, nor for reports of common diseases.

HOST ABBREVIATIONS

AL = Alder	BM = Bigleaf maple
BP = Bishop pine	CN = Conifer
DF = Douglas-fir	FV = Modesto ash
GF = Grand fir	HW = Hardwoods
IC = Incense-cedar	JP = Jeffrey pine
KP = Knobcone pine	LP = Lodgepole pine
MA = Madrone	MP = Monterey Pine
PC = Pear	PM = Pinyon pine
POC = Port-Orford cedar	PP = Ponderosa pine
PS = Digger pine	RF = Red fir
RW = Redwood	SF = Sugar pine
TF = True firs	TO = Tan oak
WF = White fir	WJ = Western juniper
WRC = Western red cedar	WWP = Western white pine

STATUS AND CONTROL OF ANIMAL PESTS

A Report to the California Forest Pest Council
from the Animal Damage Committee



Gregory A. Giusti, Chair
Robert H. Schmidt, Secretary

Edited by Pamela J. Tinnin

1 December 1989

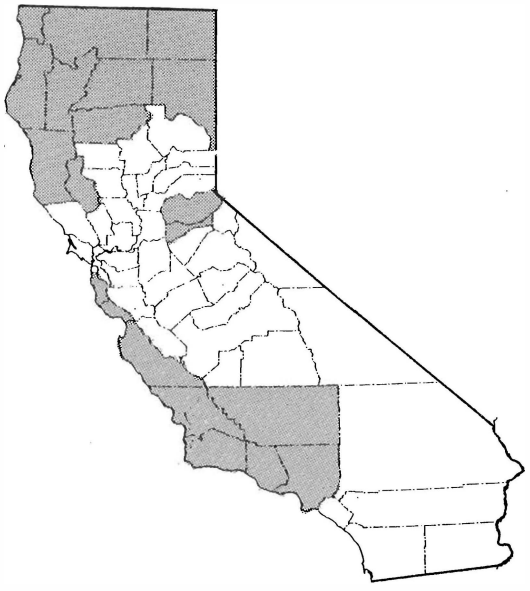
Introduction

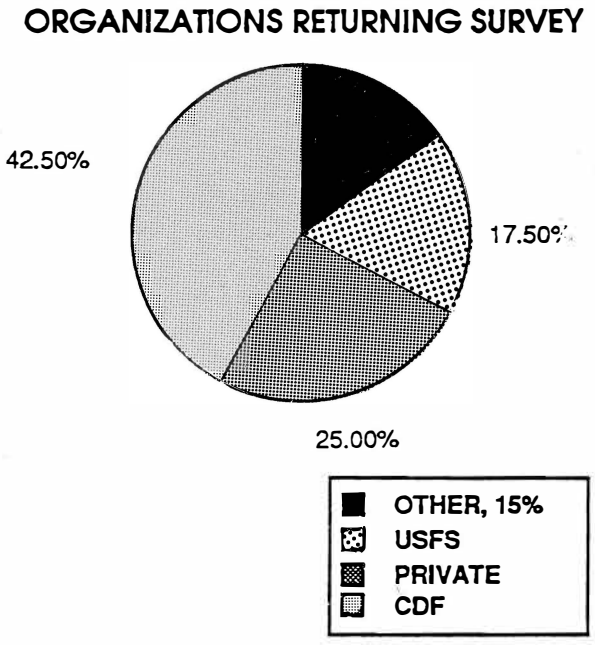
This report is the compendium of the "Animal Damage to Forest Trees" survey sent out as part of the California Forest Pest Council Animal Damage Committee's annual overview of forest vertebrate pest conditions in California.

In September, 1989, we sent out 85 "Animal Damage to Forest Trees" surveys to state, federal, and prviate foresters, companies, and agencies throughout California. Forty-five (53%) were returned and are included in this analysis.

Respondents and Location of Reports

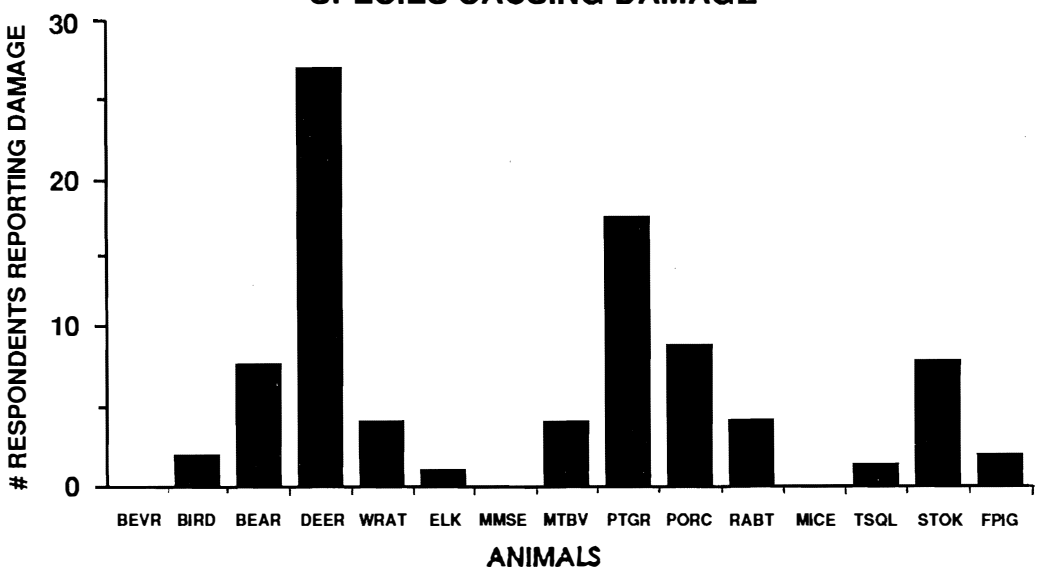
Surveys were returned by representatives of the U.S. Forest Service (n = 7), California Department of Forestry and Fire Protection (n = 17), private timber companies (n = 10), and other organizations (n = 6; BLM, So. Con Edison, and University of California Cooperative Extension). Damage was reported from 20 counties. Counties represented by the returned reports cover approximately 1/2 of the land area of California (represented below in black).





Species Causing Damage

A variety of mammal species are causing damage to forest trees, and the damage varies by area and agency. The majority of respondents reported damage from deer and pocket gophers (below). No damage from meadow mice or other "mice" (which may include shrews) was reported.



BEVR	-	beaver (*Castor canadensis*)
BIRD	-	birds (*Aves*)
BEAR	-	black bear (*Ursus americanus*)
DEER	-	mule deer (*Odocoileus hemionus*)
WRAT	-	woodrat (*Neotoma* spp.)
ELK	-	elk (*Cervus elaphus*)
MMSE	-	meadow mice (*Microtus* spp.)
FPIG	-	Feral pigs (*Sus scrufa*)
MTBV	-	mountain beaver (*Aplodontia rufa*)
PTGR	-	pocket gopher (*Thomomys* spp.)
PORC	-	porcupine (*Erethizon dorsatum*)
RABT	-	rabbit (*Lepus* or *Sylvilagus* spp.)
MICE	-	other "mice" (*Peromycus, Sorex* spp.)
TSQL	-	tree squirrels (*Sciurus* spp.)
STOK	-	domestic stock (cattle and sheep)

Number of Respondents Reporting Damage
(excluding "others", n = 45)

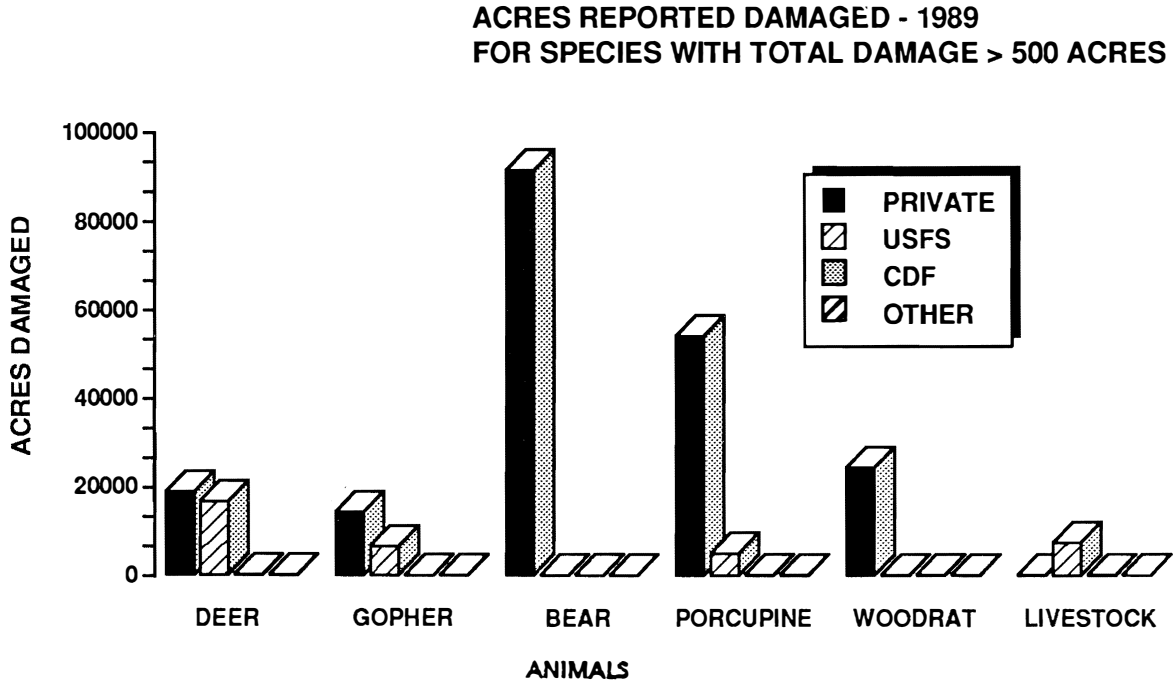
SPECIES	USFS	CDF	PRIVATE	TOTAL
Beaver	0	0	0	0
Birds	0	2	0	2
Bear	1	4	3	8
Deer	7	10	9	26
Woodrat	0	1	3	4
Elk	0	1	1	2
Meadow Mice	0	0	0	0
Mountain Beaver	1	2	1	4
Pocket Gopher	5	2	10	17
Porcupine	3	2	4	9
Rabbit	1	3	0	4
"Mice"	0	0	0	0
Tree Squirrels	0	2	0	2
Domestic Stock	4	2	2	8
Feral Pigs	0	1	0	1

Scope of Damage

Damage from all sources was reported on 251,950 acres of forest lands.

NUMBER OF ACRES DAMAGED

SPECIES	USFS	CDF	PRIVATE	OTHER	TOTAL
Beaver	0	0	0	0	0
Birds	0	3	0		3
Bear	100	1000	90000	800	91900
Deer	18460	1000	20540	0	40000
Woodrat	0	0	23300	0	23300
Elk	850	2000	4000	0	6850
Meadow Mice	0	0	0	0	0
Mountain Beaver	250	0	200	50	500
Pocket Gopher	7145	15	14337	0	21497
Porcupine	5000	15	52800	0	57815
Rabbit	20	10	0	0	30
"Mice"	0	0	0	0	0
Tree Squirrels	0	100	0	0	100
Domestic Stock	4600	5	500	0	5105
Ground Squirrels	0	5	0	0	5



Discussion

Animal damage to forests is not on the decline in California. Pocket gophers, black bear, and deer continue to be significant problems, and indications are that pocket gopher and black bear damage is on the increase. With additional restrictions on the use of strychnine as a rodenticide, continued damage must be anticipated. Deer damage is a continual but predictable problem, and the use of seedling protection devices and repellents continue to make this problem manageable, at least in some areas. Bear damage along the north coast continues to be a problem, and sociopolitical factors will continue to make this a "high exposure" situation for the future.

The Animal Damage Committee anticipates revising the "Animal Damage to Forest Trees" survey to allow more rigorous analyses and between-year comparisons. We hope to have a revised survey in use for the 1990 conditions report.

Acknowledgements

We thank all the participants throughout California who completed the condition report forms. Pam Tinnin was particularly helpful in upgrading the appearance of this year's report.

BEAVER

NO DAMAGE REPORTED IN 1989

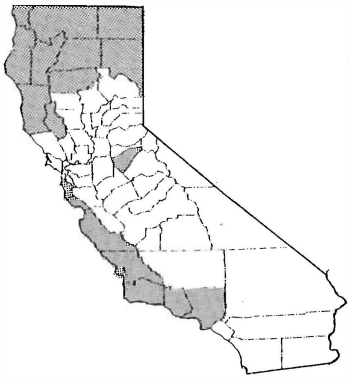
BIRDS

Species Damaged: Douglas Fir
Damage Trend: Decreasing.
Control Methods: Netting (50%), None (50%)
Damage Location: Santa Cruz, San Mateo, and Mendocino Counties
Comments: Damage reported in seedling nurseries.

BEAR

Species Damaged: Redwood, Douglas Fir, Hemlock, Ponderosa Pine
Damage Trend: Increasing.
Control Methods: None (100%)
Damage Location: Del Norte, Humboldt,and Siskiyou Counties
Comments: Damage generally to trees 10-80 years old, 0-20 trees/ac. reported damaged.

DEER



Species Damaged: White Fir, Pondersa Pine, Douglas Fir, Jeffrey Pine, Red Fir, Coulter Pine, Lodgepole Pine
Damage Trend: Generally stable.
Control Methods: Seedling Protection (48%), Repellents (7%), Hunting (15%), None (30%)
Damage Location: Tehama, Lake, Mendocino, Siskiyou, Shasta, Trinity, Lassen, Modoc, Humboldt, Calaveras, Del Norte, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles Counties.
Comments: Most damage occurs in plantations to seedlings and trees less than 10 years old.

POCKET GOPHER

Species Damaged: Jeffrey Pine, Ponderosa Pine, White Fir, Red Fir, Douglas Fir, Incense Cedar, and Lodgepole Pine
Damage Trend: Static to Increasing.
Control Methods: Strychnine (53%), Disking (6%), None (41%)
Damage Location: El Dorado, Siskiyou, Shasta, Modoc, Humboldt, Amador, Lassen, Calaveras, Kern, Los Angeles, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Trinity Counties
Comments: Most damage concentrated on trees in 1-10 year age class.

PORCUPINE

Species Damaged: Ponderosa Pine, Pinyon Pine, Jerry Pine, Lodgepole Pine, Douglas Fir
Damage Trend: Stable to Increasing.
Control Methods: Trapping (18%), Baiting (9%), None (73%)
Damage Location:
Modoc, Siskiyou, Humboldt, and Del Norte Counties
Comments: Damage is generally directed toward older trees (25-60 years), but some damage occurs to trees in the 3-25 year age class.

RABBITS

Species Damaged: Douglas Fir, Jeffrey Pine, and Redwood
Damage Trend: Increasing.
Control Methods: Seedling Protection (50%), None (50%)
Damage Location: Del Norte, Humboldt, San Mateo, and Santa Cruz Counties
Comments: Damage to 1-4 year old stock in plantations.

Species Accounts

WOODRAT

Species Damaged: Douglas Fir, Redwood
Damage Trend: Stable.
Control Methods: None (100%)
Damage Location: Humboldt and Mendocino Counties
Comments: Damage occurs to trees in 1-20 year age class in plantation environment.

ELK

Species Damaged: Ponderosa Pine, Jeffrey Pine, Sugar Pine, Douglas Fir, Incense Cedar, and White Fir
Damage Trend: Stable to Increasing.
Control Methods: Hunting (50%), None (50%)
Damage Location: Humboldt County
Comments: Damage is concentrated in 1-5 year age class, 5 to 50 trees/ac. reported damaged.

MEADOW MOUSE

NO DAMAGE REPORTED IN 1989.

MOUNTAIN BEAVER

Species Damaged: Douglas Fir, White Fir, Red Fir, Incense Cedar, Ponderosa Pine, Port Orford Cedar
Damage Trend: Stable.
Control Methods: None (100%)
Damage Location: Siskiyou, and Humboldt Counties
Comments: Damage occurs to trees in 1-20 year age class.

"MICE"

NO DAMAGE REPORTED IN 1989.

TREE SQUIRRELS

Species Damaged: Jeffrey Pine, Lodgepole Pine, and Coulter Pine
Damage Trend: Increasing.
Control Methods: Hunting (50%), Exclusion (50%)
Damage Location: San Mateo, Santa Cruz, and El Dorado Counties
Comments: Damage to trees between 1 and 110 years.

DOMESTIC STOCK

Species Damaged: Ponderosa Pine, Lodgepole Pine, Douglas Fir, White Fir, Red Fir, Jeffrey Pine
Damage Trend: Generally Stable.
Control Methods: Fencing (13%), Seedling Protection (25%), None (62%)
Damage Location: Siskiyou, Shasta, Trinity, Lassen, and Humboldt Counties
Comments: Damage, through feeding and trampling, to 1-10 year age class.

FERAL PIGS

Species Damaged: Douglas Fir
Damage Trend: Increasing.
Control Methods: None (100%)
Damage Location: San Mateo and Santa Cruz Counties
Comments: This is the first reported documented evidence of forest damage from feral pigs.

STATUS AND CONTROL OF WEEDS

Weed competition continues to be a serious problem to the survival and growth of forest plantations in the state. As massive reforestation efforts continue on the burned acreage of the 1987 forest fires, weed competition in conifer plantations is expected to continue to threaten regeneration success. This problem is compounded by the herbicide moratorium on Federal ownership. The primary methods for weed control on National Forests are limited to mechanical and biological methods, but the Regional Forester's decision (2/27/89) for the Vegetation Management Final Environmental Impact Statement will provide for renewed use of herbicides. Several appeals to this document are currently pending.

Although several common herbicides were dropped from registration due to low sales and the added costs of filling "data gaps" required by SB 950, the primary method of weed control on private forest lands remains the application of herbicides. The most recent figures from the California Department of Food and Agriculture indicate that a total of 27,349 acres were treated in 1987 (Table V). Data for 1988 were not yet available.

Table V. Herbicide Use on California Forest Lands for 1987

Chemical	Acres Treated
Asulam*	39
Atrazine	106
2,4-D	8,296
Dalapon	200
Dichlorprop	161
Glyphosate	1,939
Hexazinone	5,693
Picloram*	98
Triclopyr	10,817
TOTAL	27,349

* No longer registered for use in California.

Weeds continue to be a primary pest problem at the Placerville Nursery, El Dorado County.

DEMONSTRATION THINNING PLOTS IN THE EASTSIDE PINE TYPE ON THE LASSEN NATIONAL FOREST. In 1978-1979 the Forest Service established plots in the eastside pine type to show the effects of thinning on pest-caused losses in areas of high tree mortality. The stands chosen were mostly pole-size ponderosa pine mixed with some white fir and incense-cedar, growing on medium to low sites, and ranging in age from 70 to 90 years. Within the demonstration plots, four levels of stocking density -- 40, 55, 70, and 100 percent of normal basal area -- were established to demonstrate the biological and economic alternatives available for management planning. (Normal basal area is the basal area that a stand should have when fully stocked with trees which, in the demonstration areas, ranges from 185 to 215 sq ft/ac depending on site quality.) Ten years after thinning, the treatments had reduced mortality from 89 to 100 percent of the level in unthinned stands (Table VI).

TABLE VI. COMMERCIAL TREE MORTALITY BY STOCKING LEVEL, TEN YEARS AFTER THINNING[a]

Year	Residual Stocking After Thinning[b] 40%	55%	70%	100%
		Trees per Acre		
1980	0.0	0.2	0.2	2.4
1981	0.0	0.0	0.7	2.4
1982	0.0	0.5	0.3	3.6
1983	0.0	0.1	0.8	4.1
1984	0.0	0.0	0.0	1.0
1985	0.0	0.2	0.0	0.6
1986	0.0	0.0	0.0	1.3
1987	0.0	0.0	0.0	1.4
1988	0.0	0.0	0.0	0.0
1989	0.0	0.4	0.0	2.6
Mean	0.0	0.1	0.2	1.9
Range	0	0-0.5	0-0.8	0.0-4.1
Percent Mortality Reduction Compared with Normal Basal Area	100	94.7	89.5	---

a. Commercial trees are 8 inches dbh and larger, with straight boles, yielding a 10-foot log with a 6-inch top. Trees were killed by the mountain pine beetle.
b. Percent of normal basal area.

MORTALITY IN THE NATIONAL FORESTS OF CALIFORNIA.

High levels of tree mortality in 1988 and 1989 (Table VII) were primarily a consequence of below normal precipitation for three consecutive, and four of the last five years (Table VIII), in the Sierra Nevada Mountains. Tree mortality in northwestern California was much less than that occurring in the Sierras. Precipitation in this area was nearer normal levels.

TABLE VII. ESTIMATED MORTALITY AND SALVAGE ON SELECTED NATIONAL FORESTS IN CENTRAL AND NORTHERN CALIFORNIA[a]

National Forest	Mortality MMBF		Salvage MMBF		Land Base Acres (xM)	
	1988	1989	1988	1989	1988	1989
Eldorado	60.0	250.0	30.0	143.0	307	304
Inyo	0.1	0.6	0.0	0.0	110	75
LTBMU[b]	1.0	50.0	0.3	3.0	15	15
Sequoia	6.3	16.0	1.7	7.0	420	345
Sierra	14.7	50.0	6.6	25.5	390	390
Stanislaus	16.0	180.0	8.6	60.0	393	393
Plumas	40.0	100.0	15.0	30.0	480	480
Tahoe	15.0	50.0	3.0[c]	14.0	528	528
Klamath	48.85	59.75	10.225	22.2-22.4[d]	840.3	840.3
Mendocino	5.025	11.55-13.55	4.825	5.3-5.7	285.2	285.2
Shasta-Trinity	14.657	41.5	7.057	22.2	799	799
Six Rivers	6.2	13.1-12.25	3.9	1.5	453.55	453.55
Total	227.7	823.0	91.2	334.8	5,021	4,908

a. Estimates are limited to commercial trees 12 inches dbh and larger.
b. Lake Tahoe Basin Management Unit. Total 1989 mortality in the LTBMU was 200 MMbf over 140,000 acres, but 100 MMbf was in wilderness areas and 50 MMbf was on lands intermixed with small private holdings which made salvage difficult.
c. All but about 3 of 104.5 MMBF was fire salvage from 1987 fires.
d. The midpoint of each range was used to arrive at a total.

For comparison, precipitation totals at the Georgetown Ranger Station during the 1975-1977 drought were: 1975-76 -- 24.52 inches, 44% of average; 1976-77 -- 22.58 inches, 40% of average. The previous drought was of shorter duration, but somewhat more severe in terms of moisture deficit.

TABLE VIII. PRECIPITATION LEVELS AT TWO LOCATIONS ON THE ELDORADO NATIONAL FOREST, WATER YEARS 1984 TO 1989.

	Georgetown Ranger Station		Placerville Nursery	
Year (7/1 to 6/30)	Total Precipitation (inches)	% of Average (55.98 inches) (110 year ave.)	Total Precipitation (inches)	% of Average (44.41 inches) (10 year ave.)
1984-85	41.51	74%	29.92	67%
1985-86	77.95	139%	56.53	127%
1986-87	30.98	55%	22.37	50%
1987-88	35.01	63%	25.19	57%
1988-89	46.72	83%	32.82	74%

Trees stressed by inadequate moisture have their natural defenses weakened to the extent that they become more susceptible to attack by bark and engraver beetles. Other factors, such as dwarf mistletoes, competing vegetation, root diseases, soil compaction, and physical damage to trees from construction or logging activities, can also contribute to stress and predispose trees to bark beetle attack.

The most important trees being affected are ponderosa and sugar pine, and red and white fir. The main beetles involved are: a) pine engravers, Ips spp., which attack native pines and tend to build up in slash; b) the fir engraver, Scolytus ventralis, which attacks true firs; c) the western pine beetle, Dendroctonus brevicomis, which attacks ponderosa pine; and d) the mountian pine beetle, D. ponderosae, which attacks sugar and ponderosa pine.

In 1988, mortality early in the year was more prevalent in fir in the mid- to upper-elevations in the central and southern Sierra Nevada Mountains. Low elevation pine mortality increased from mid-summer through the end of the year. Mortality was reported more or less uniformly distributed throughout forests and districts, with pine mortality somewhat more prevalent on south-facing slopes. Exceptions included pine mortality concentrated in the Oakhurst Basin and environs of the Mariposa Ranger District (Sierra National Forest), and fir mortality concentrated around Breckenridge Mountain on the Greenhorn Ranger District (Sequoia National Forest).

In 1989, above normal mortality continued in the mid- to upper-elevation true fir and mixed conifer types on the Eldorado and Stanislaus National Forests and in addition, is now scattered in pockets throughout most of the lower elevation pine type and adjacent woodlands. The Lake Tahoe Basin Managmenet Unit, the Mariposa District (Sierra National Forest) and the Greenhorn Ranger District (Sequoia National Forest) also continue to experience accelerated mortality from drought and bark beetle attack.

During the 1975-1977 drought, insect mortality was concentrated in large, high volume pine trees at the lower elevations. Current mortality is much more widely dispersed, concentrated in both larger and smaller trees, and consists of both fir and pine. Compared to the 1975-1977 drought, this makes salvage harvest more complex and difficult.

Experience from the 1975-1977 drought indicates that surviving trees can regain their vigor relatively quickly after precipitation and soil moisture levels return to normal. Based on survey data from northern California Forests, mortality declined from about 5.5 billion board feet in 1977 to about 1.0 billion board feet in 1978. To the extent that stands respond as they did following the 1975-77 episode, if precipitation is at least average in 1989-90, mortality may return to more-or-less normal levels by the fall of 1990.

ETHEPHON TRIALS IN CALIFORNIA. Ethephon (Florel™) is an ethylene-releasing plant growth regulator. A concentration of 2500 ppm was applied with a backpack sprayer to female dwarf mistletoe shoots on the following parasite and host combinations: western dwarf mistletoe, Arceuthobium campylopodum, on Pinus ponderosa (Boggs Mountain Demonstration State Forest) and P. jeffreyi (Latour Demonstration State Forest), and lodgepole pine dwarf mistletoe, Arceuthobium americanum, on Pinus contorta (Latour Demonstration State Forest). After five weeks dwarf mistletoe abscission rates ranged from 96% to 100%. There was some damage to host tree needles, particularly in Pinus contorta. One year after treatment 65% of the treated branch infections on the Jeffrey and ponderosa pine had resprouted, but only 10% resprouted on the lodgepole pine.

In 1989, Ethephon was applied in the same manner to dwarf mistletoe shoots on additional Jeffrey pine at Latour Demonstration State Forest. A concentration of 2500 ppm caused 90% of the mistletoe shoots to abcise, but 92% of the treated infections were resprouting after five weeks.

In addition, fifteen infected ponderosa pine at Boggs Mountain Demonstration State Forest were sprayed to runoff with a concentration of 2700 ppm. After five weeks, spraying the entire tree with a high pressure sprayer resulted in the abscission of 65% of the mistletoe shoots evaluated. Regrowth occurred after five weeks in 59% of the branch infections examined.

ANNOSUS ROOT DISEASE CONTROL. In 1978, Forest Pest Management USFS, San Francisco, mapped 45 annosus root disease centers in a proposed recreation development on the north shore of Big Bear Lake, San Bernardino National Forest. In March 1989, these centers in Jeffrey pine and western juniper were remapped, and six were selected to demonstrate the feasibility of establishing and maintaining vegetative cover in annosus root disease centers in recreation sites. Annosus-infected stumps and roots were uprooted, and margins of disease centers were trenched in order to break root contacts and prevent spread to adjacent healthy trees. Exposed root systems were examined to determine the amount of root colonization by the fungus in relation to above ground crown symptoms.

In July, 178 trees and 24 stumps were removed from the annosus root disease centers with a backhoe, loader, and dump truck (Figs. 6 to 9). About 200 feet

of trench was dug and 101 isolations were made from uprooted trees. Positive isolations were made from 24 ponderosa pines and 23 junipers. The area will be planted with resistant and non-resistant species in 1990, and growth and survival will be monitored for ten or more years.

TREE DIAGNOSES, CDF&A. The California Department of Food and Agriculture is frequently requested to identify the cause of injury or disease on various species of trees. The latest listing is given in Table IX.

Figures 6 to 7. Removal of trees and stumps from six annosus root disease centers on the San Bernardino National Forest. Upper, pushing over one of the pines; lower, piling uprooted materials. (Photos courtesy USDA-Forest Service).

Figures 8 and 9. Removal of trees and stumps from six annosus root disease centers on the San Bernardino National Forest. Upper, moving a split stump; lower, a large root with annosus root rot. (Photos courtesy USDA-Forest Serv.)

TABLE IX CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE, TREE DIAGNOSES 10/88 THROUGH 9/89

HOST TREE	DIAGNOSIS	COUNTY
Abies concolor (white fir seedling)	*Phytophthora sp.*, root rot	Sonoma
Abies concolor (white fir)	*Arceuthobium abietinum* f. sp. *concoloris*, dwarf mistletoe	Placer
Abies concolor	*Cytospora abietis*, canker	Tuolumne
Abies magnifica (red fir, nursery soil)	*Fusarium oxysporum*	Butte
Acer sp. (maple)	Bromacil herbicide injury	unlisted
Acer palmatum (Japanese maple)	*Dothiorella sp.*, isolated fromcanker, unknown pathogenicity	Contra Costa
Acer palmatum	Leaf miner injury	Sacramento
Alnus sp. (alder)	Sunburn cankers on west side of alder tree trunks.	Sacramento
Alnus cordata (Italian alder)	*Xanthomonas campestris*, leaf blight	Sacramento
Alnus incana (white alder)	*Phytophthora sp.*, isolated from specimen.	Sacramento,Butte
Alnus incana	*Xanthomonas campestris*, leaf blight.	Sacramento
Alnus rhombifolia (white alder)	*Xanthomonas campestris*, leaf blight	Sacramento
Arbutus mensziesii (madrone)	Herbicide injury, possibly triazine	Humboldt
Arctostaphylos sp. (manzanita)	Injury, *Coptodisca arbutiella*, madrone shield bearer	Sacramento
Arctostaphylos sp.	*Fusicocum aesculi*, madrone/manzanita canker	Sacramento
Betula sp. (birch)	Borer injury	Sacramento
Betula sp. (birch)	*Phyllosticia betulina*, leafspot	Tehama
Betula alba (European white birch)	*Melampsoridium betulinum*, rust	Sonoma
Betula nigra (river birch)	Flat headed borer injury	Butte
Caryota urens (fishtail palm)	*Fusarium moniliforme*, leafspot	Colusa
Ceratonia siliqua (carob)	*Erwinia carotovora* ssp. *carotovora*, bacterial soft rot	Santa Clara
Cercis canadensis (eastern redbud)	Drought injury	Calaveras
Cinnamomum camphora (camphor)	Contact chemical injury	Butte
Cornus florida (dogwood)	*Nectria galligena*, "canker"	Placer
Crataegus sp. (hawthorn)	*Gymnosporangium clavipes* , rust	Plumas
Cupressus sp. (cypress)	*Seiridium cardinale*, cypress canker	San Mateo
Cupressus pygmaea (cypress)	*Seiridium cardinale*, cypress canker	San Francisco
Eucalyptus camaldulensis (red gum)	*Erysiphe cichoracearum*, powdery mildew on seedling	Sacramento
Fraxinus oxycarpa (raywood ash)	Round-up herbicide injury	Tuolumne

TABLE IX (cont.)

HOST TREE	DIAGNOSIS	COUNTY
Fraxinus sp. (ash)	*Tropidosteptes amoenus*, ash plant bug injury	Placer
Fraxinus sp. (ash)	*Podesesia syringae*, lilac/ash borer injury	Sacramento
Fraxinus velutina var. *glabra* (Modesto ash)	*Gloeosporium aridium*, anthracnose	Sacramento
Ginko biloba (ginko, maidenhair)	*Pseudomonas syringae*, leafspot	Sacramento
Juglans sp. (walnut)	Bromacil herbicide injury	Sacramento
Laurus nobilis (laurel)	*Armillaria mellea*, oak root fungus	Sacramento
Liquidambar sp. (sweetgum)	*Phyophthora cactorum*, root and crown rot	Sacramento
Liquidambar styraciflua (sweetgum)	*Diplodia spp.*, leader dieback	Sacramento
Lithocarpus censiflora (tanoak)	*Ganoderma applanatum*, heart and root rot	Santa Cruz
Magnolia soulangiana (saucer magnolia)	*Oidium sp.*, powdery mildew	Contra Costa
Mahonia aquifolium (Oregon grape)	*Cumminsiella mirabilissima*, rust	Sacramento
Malus sylvestris (apple)	*Erwinia amylovora*, fire blight	Calaveras
Malus sylvestris	Jonathan spot, physiological spotting (water imbalance in the fruit)	Sacramento
Malus sylvestris	*Venturia inaequalis*, apple scab	Yolo?
Malus sylestris	*Eriosoma americanum*, Woolly apple aphid injury	Marin
Morus sp. (mulberry)	*Pseudomonas syringae*, leafspot	Sacramento
Morus alba (white mulberry)	Dicamba and urea or Uracil herbicide injury	Mendocino
Morus alba (white mulberry)	Roundup herbicide injury	Contra Costa
Nerium oleander (oleander)	*Phoma exigua*, pruning wound dieback	Sonoma
Nerium oleander	*Pseudomonas syringae* pv. *savastanoi*, knot	San Mateo
Persea americana (avocado)	Avocado sun blotch viroid	Ventura
Phoenix roebelenii (Pygmy date palm)	*Phoenicococcus marlatti*, red date scale injury	Riverside
Pinus jeffreyi (Jeffrey pine)	*Matsucoccus fasciculensis*, scale	El Dorado
Pinus lambertiana (sugar pine)	*Fusarium oxysporum*, in nursery soil	Butte
Pinus monophylla (singleleaf pinyon pine)	*Cytospora sp.*, canker	Sierra
Pinus radiata (Monterey pine)	*Fusarium subglutinans*, pine pitch canker	San Diego, Los Angeles
Pinus radiata	*Endocronartium harknessii*, gall rust	Santa Cruz
Pinus radiata	*Pityophthorus sp.*, twig beetle damage	Santa Clara
Pinus sylvestris (Scotch Pine)	Gall-insect injury	Alameda
Pistacia chinensis (Chinese pistachio)	*Verticillium dahliae*, verticillium wilt	Sonoma
Pistacia chinensis	Phenoxy herbicide injury	Sacramento